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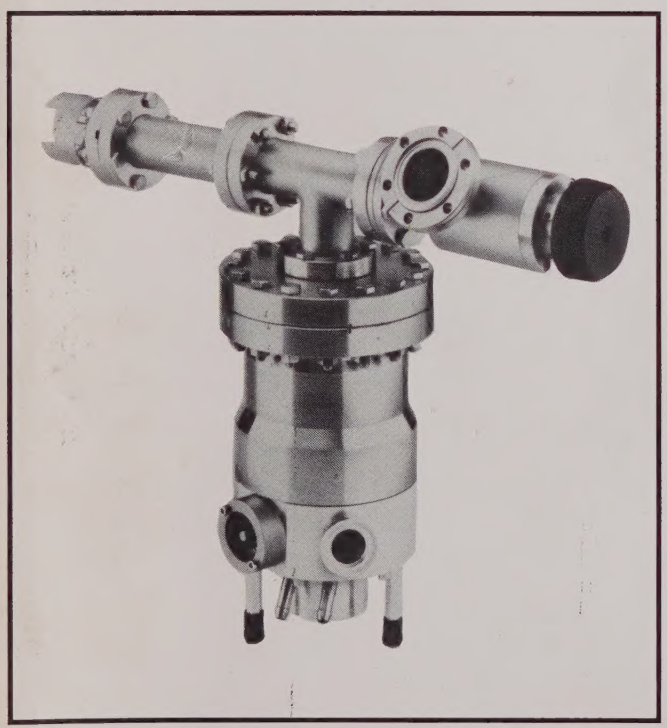
Part Number 074-060

IPC-2 Pressure Converter MANUAL



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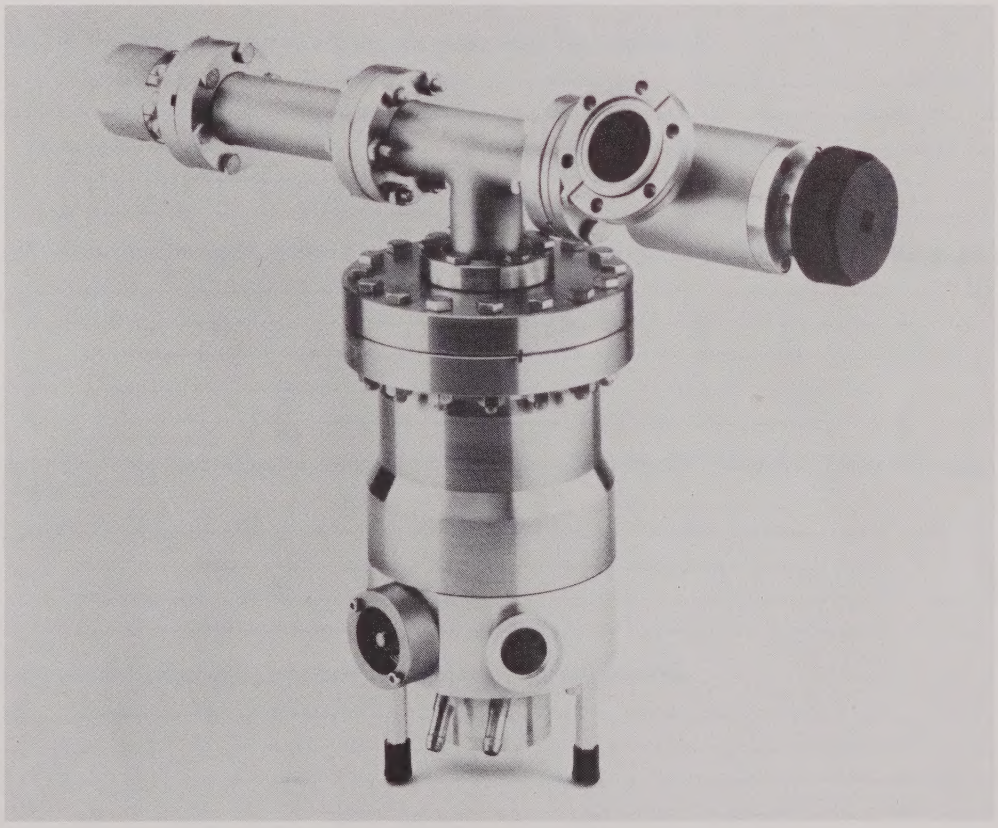
IPC-2
Pressure Converter
Technical Manual

June 1984



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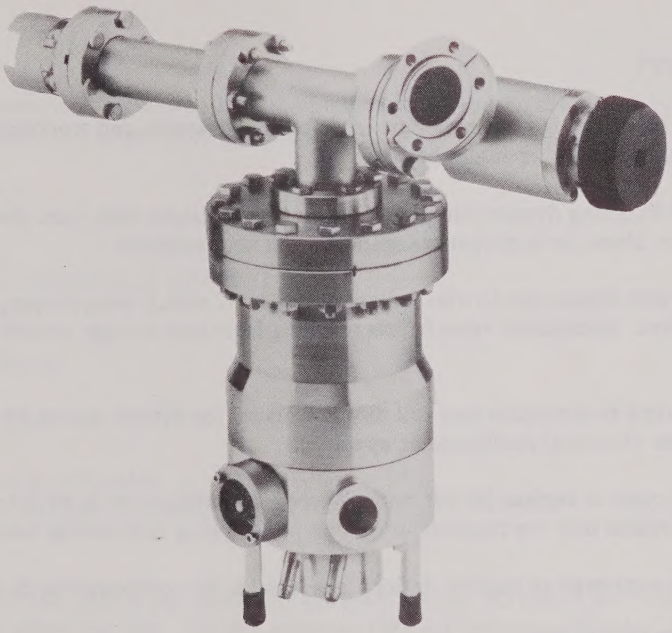
THE IPC-2 PRESSURE CONVERTER



The IPC-2 is a low-cost pressure converter for the Quadrex family of gas analyzers and partial pressure controllers that extends the sampling pressure range of the quadrupole's sensors from 10^{-4} to 10 torr. This means you can monitor and control your vacuum system at base pressure, during gas backfill, and throughout your plasma process—regardless of whether yours is a sputtering, etching, or deposition process.

The IPC-2 is a two-stage, single valve design because a single valve is easier to use, more cost effective, and more compact. This unique valve (patent pending) has one knob with three positions--orifice sampling with positive locking detent, high vacuum sampling, and closed. For applications that always exceed 10^{-4} torr, the IPC-2 is easily converted to a two position device that prevents opening the valve to the high vacuum sampling position.

The valve is Viton® sealed and bakeable to 190°C.

The IPC-2's precision stainless steel orifices are reusable and easily interchangeable. They are available in 10 millitorr, 150 millitorr, 1 torr, and 10 torr, so you can select one specifically designed to sample your particular process.

The IPC-2 is available with a turbomolecular or an ion pump. Either can be used with any of the Quadrex quadrupole sensor heads.

The turbo pump version can be used for plasma applications whose duty requirements exceed ion pump capacities.

The ion pumped IPC-2 is suitable in applications where the gas load is minimal and the majority of gases are not inert or hydorcarbon in nature.

■ IPC-2 WARRANTY

The IPC-2 Pressure Converter is warranted against defects in materials and workmanship for one year from the date of shipment, except as hereunder listed.

Vacuum Differential Pumping System pumps are warranted for ninety days from date of shipment. Claims resulting from misuse, abuse, or improper maintenance will be disallowed.

Electro-Pneumatic Valve failure due to over temperature (190°C max.), over voltage, or air pressure line problems is not covered. Mechanical valve failure resulting from seat damage caused by over-torqueing is not covered.

Inficon reserves the right to determine and will disallow claims for defects caused by your modifications, abuse, misuse or other abnormal conditions of operation.

In addition, we will repair or replace (at our option) products which prove to be defective during the Warranty period, provided they are returned to Inficon per shipping instructions below.

No other warranty is expressed or implied. Inficon is not liable for consequential damages.

■ SHIPPING INSTRUCTIONS

Before returning any instrument to Inficon Leybold-Heraeus, Inc. for service, be sure to contact our service department (listed below) for a Return Material Authorization (RMA) number. Items will not be accepted without an assigned RMA. They must also be properly packaged, insured, and shipped transportation charges prepaid to one of the service departments.

■ INFICON SERVICE DEPARTMENTS

EAST COAST
Inficon Leybold-Heraeus, Inc.
6500 Fly Road
East Syracuse, New York 13057
(315) 437-03777 TWX: 710 541-0594

WEST COAST
Inficon Leybold-Heraeus, Inc.
1455 Airport Boulevard
East Building
San José, California 95110
(408) 279-1425 TWX: 910 338-0144

■ PREFACE

The IPC-2 Manual is written for people who install, operate, and maintain the IPC-2 Pressure Converter. A general outline of the format and contents of this manual is below.

IPC-2 SPECIFICATIONS
DESCRIPTION
TABLE OF CONTENTS
ILLUSTRATIONS AND DIAGRAMS LISTING
INSPECTION AND INVENTORY
INSTALLATION
REPLACING THE ORIFICE
OPERATION
THEORY OF OPERATION
MAINTENANCE
HEATING JACKET INSTRUCTIONS
AIR COOLER INSTALLATION INSTRUCTIONS
SCHEMATICS

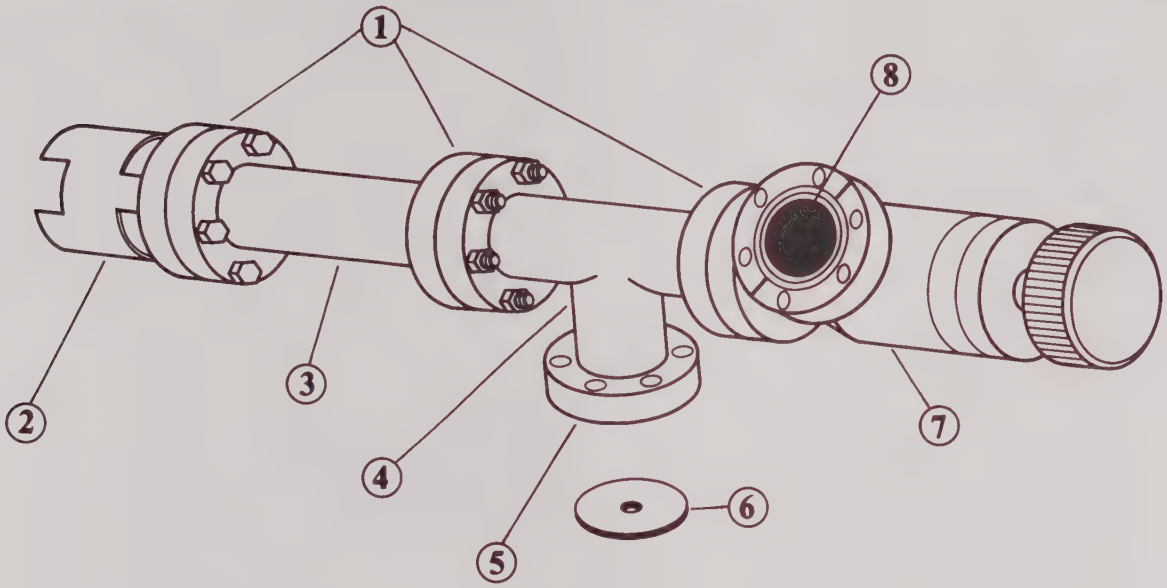
When using the IPC-2 Manual, please pay particular attention to the NOTES, CAUTIONS, and WARNINGS found throughout the text. For our purposes they are defined as follows:

NOTES:	Pertinent information useful in achieving maximum instrument efficiency when followed.
CAUTIONS:	Failure to heed these messages could result in damage to your instrument.
WARNINGS:	The most important messages. Failure to heed could result in personal injury and/or serious damage to your instrument.

We invite you to comment on the usefulness and accuracy of this manual by filling out the reply card and returning it to us.

■ IPC-2 SPECIFICATIONS

Base Pressure:	1×10^{-8} torr
Maximum Operating Pressure:	Dependent on customer selected orifice. Sizes from 10 millitorr to 10 torr are available.
Orifices:	Precision stainless steel orifices, reusable and interchangeable. Available in 10 millitorr, 150 millitorr, 1 torr, and 10 torr.
Turbo Pump Package:	Turbo Pump--150 liter/second capacity, water cooled, eight gallons per hour. Weight--16 lbs. (7.3 kg.) Turbo Pump Controller--120 Vac, 60Hz, 30 amp max. Weight--26 lbs. (ll.8 kg.) Interconnect cable from controller to pump--16 ft. (4.9 m) Mechanical Pump--2.2 CFM, 120 Vac, 60 Hz, 7 amp max. (1/3 HP), single phase. Weight--45 lbs. (20.4 kg.) Venting Device--120 Vac, 3 to 5 psig. gas inlet pressure.
Ion Pump Package:	Ion Pump--20 liter/second capacity. Weight--21 lbs. (9.6 kg.) Ion Pump Power Supply--120 Vac. 60 Hz, 10 amp max. Weight--33 lbs. (15 kg.) Interconnect cable from power supply to pump--10 ft. (3.3m)
Mating Flange:	2-3/4″ ConFlat®
Valve Type:	1-1/2″ bellows sealed, Viton® gasket, bakeable to 190°C, manual or electropneumatic.
Shipping Weight:	Turbo pump version--140 lbs. (63.6 kg.); Ion pump version--90 lbs. (40.1 kg.)
Options:	Electropneumatic valves--Viton® gaskets, bakeable to 190°C, 120 Vac, air pressure--50 lbs. to 125 lbs. psig. Heating jacket assembly--fitted design, insulated, thermostated to 190°C. Three piece assembly for IPC-2 manifold, connecting tee and quadrupole head. Available in Faraday cup and electron multiplier versions. Turbo pump air cooler kit--replaces water cooling with air fan mounted to bottom of turbo pump. 120 Vac.



1. FLANGES	These ConFlat® compatible flanges are 2-3/4 inch OD UHV. They are identical mating (no male or female) and leak tight when properly installed.
2. FARADAY CUP SENSOR	Electron multiplier sensor may be subsituted in place of this sensor.
3. FARADAY CUP ADAPTER	Standard nipple configuration. UHV quality.
4. SENSOR HOUSING	Connects IPC-2, sensor pump.
5. PUMPING PORT	The standard ConFlat® flange allows this port to be mated to the Inficon turbo or ion pump.
6. RESTRICTOR GASKET	This high quality gasket regulates the pumping speed to insure that the sensor region gases accurately reflect the composition of the sample inlet gases.
7. TWO STAGE VALVE	Single, two-stage valve with three positions; orifice sampling with positive locking detent, high vacuum sampling, and closed.
8. SAMPLE INLET	Conveniently connected, via rotatable ConFlat® flange, to your process chamber or vessel.

■ TABLE OF CONTENTS

Introduction i
Warranty ii
Preface iii
Specifications iv
Diagram/Description v

Inspection and Inventory 1
Installation 2
Replacing the Orifice 8
  Manual Valve Instructions 8
  Electropneumatic Valve Instructions 11
Operation 13
  Start-Up With Ion Pump 13
  Start-Up With Turbo-Molecular Pump 14
  Gas Analysis 15
  Shut Down 16
    Ion Pump 16
    Turbo Pump 16
Theory of Operation 17
Maintenance 19
Heating Jacket Instructions 21
Air Cooler Installation Instructions 22
Spare Parts Listing 29
Index 30

■ ILLUSTRATIONS AND DIAGRAMS

Fig. No.	Illustration	Page
	IPC-2 Photo	i
	IPC-2 Diagram	v
1	IPC-2 Pressure Converter Configurations	3
2	Alternate Mounting Arrangement	4
3	Solenoid Wiring Diagram	8
4	Manual Valve Assembly Removed	9
5	Orifice Mount Removed	10
6	Seal Installation	11
7	Electropneumatic Valve Assembly Removed	12
8	IPC-2 Vacuum Schematic	17
9	Pressure Conversion Chart	18
10	Venting Device Assembly	20
11	Heating Jacket	21
12	Turbo Pump Base - Side View	22
13	Screen Removal	23
14	Air Cooler - Top View	24
15	Air Cooler Wiring Configuration	25
16	IPC-2 Assembly (Exploded Drawing)	26
17	IPC-2 System w/Manual Valve and Ion Pump	27
18	IPC-2 System w/Manual Valve and Turbo Pump	28

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■ INSPECTION AND INVENTORY

As soon as possible after you receive the IPC-2, unpack the shipping containers and check for any visible damage. Please, notify the carrier and Inficon immediately if you find any damage.

After you unpack, be sure that you have received all the items you ordered by checking with the list provided below.

The IPC-2 assembly carton contains the following:

	PART NO:
IPC-2 Pressure Converter (with orifice installed), 8 lbs. (3.6 kg)	
Manual Valve Model, or	IPN 900-002-G1
Electropneumatic Valve Model	IPN 900-002-G2
Installation Parts Kit containing:	
(2) Copper Gaskets for 2.75" ConFlat Flange	IPN 002-065
(1) Pump Restrictor Gasket	IPN 012-318
(18) ¼ - 28 x 1½ S.S. Flange Bolts	IPN 096-001
(18) ¼ - 28 S.S. Nuts	IPN 096-003
(1) IPC-2 Pressure Converter Manual	IPN 074-060

If you ordered a complete IPC-2 system including pumping equipment, you should also have received two or more additional boxes containing one of the following:

A.	(1) Ion Pump (Varian)* 21.5 lbs. (10 kg)	IPN 012-303
	(1) Ion Pump Power Supply (Varian)* 33 lbs. (15 kg)	IPN 021-304
	OR	
B.	(1) TMP 150 Turbo-Molecular Pump* (L-H) 16 lbs. (7.2 kg)	IPN 012-357
	(1) NT 150/360 Frequency Converter* (L-H) 26 lbs. (12 kg)	IPN 012-370
	(1) 6" - 2-3/4" Adapter Flange	IPN 012-360
	(1) Venting Device Assembly	IPN 012-371
	(1) Installation Parts Kit for Turbo	IPN 012-372
	Containing:	
	(6) ¼ - 28 x 7/8 S.S. Screws	IPN 096-004
	(16) 5/16 - 24 x 2 S.S. Screws	IPN 097-001
	(16) 5/16 - 24 S.S. Nuts	IPN 097-002
	(1) Turbo Pump Instruction Manual	IPN 074-018

(cont'd)

*Includes operating instructions

(1)	D2A Pump, Rotary Vane* (L-H) 45 lbs. (20.5 kg)	IPN 012-379
(1)	SE 2/4 Smoke Eliminator (L-H)	IPN 012-378
(1)	Elbow, KF25	IPN 012-374
(1)	Hose Assembly, PVC, KF25	IPN 012-359
(2)	Centering Ring & Seal, KF25	IPN 012-375
(2)	Clamp KF20/25	IPN 012-376
(1)	Reducer KF 25/16	IPN 012-377

C. If the turbo system's air cooler option was ordered, the following will also be included:

(1) Turbo Air Cooler Kit (L-H) 3 lbs. (1.5 kg) IPN 012-400

D. If the heating jacket assembly was ordered, the following will also be included:

(1)	Heating Jacket for IPC-2 Faraday Cup System 8 lbs. (3.6 kg)	900-003-G1
(1)	Heating Jacket for IPC-2 Electron Multiplier System 8 lbs. (3.6 kg)	900-003-G2

*Includes operating instructions

■ INSTALLATION

NOTE: Three exploded assembly drawings have been included to assist you in installing the IPC-2. They are located on pages 26, 27, and 28 of this manual.

The IPC-2 is shipped partially assembled to simplify installation. Refer to Figures 1 and 2 for possible location and orientation of the IPC-2, following the instructions below:

CAUTION: Use ultra-high vacuum techniques when installing the IPC-2. Avoid contaminating vacuum surfaces with dust, grease, fingerprints or other foreign materials.

1. First, attach the IPC-2 Pressure Converter Valve Assembly to the vacuum system which is to be monitored by the Inficon quadrupole. This requires a 2.75" O.D. ConFlat® flange on your system. Use the six bolts and nuts already installed in the system mating flange of the IPC-2, after first placing one of the (supplied) copper gaskets between the flanges.

   The ConFlat® flange sealing system used in the IPC-2 makes highly reliable vacuum connections. For good results with this system, however, follow the recommendations below:

Figure 1 - IPC-2 Pressure Converter Pump Configurations

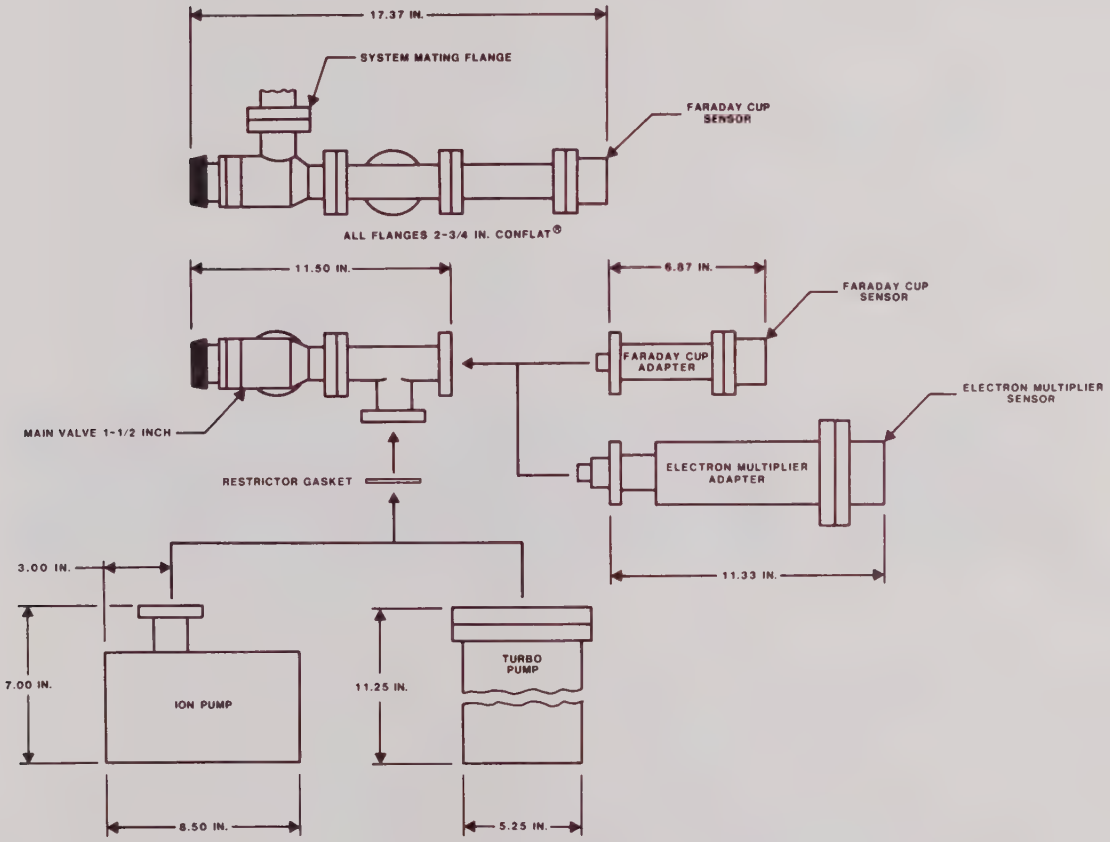
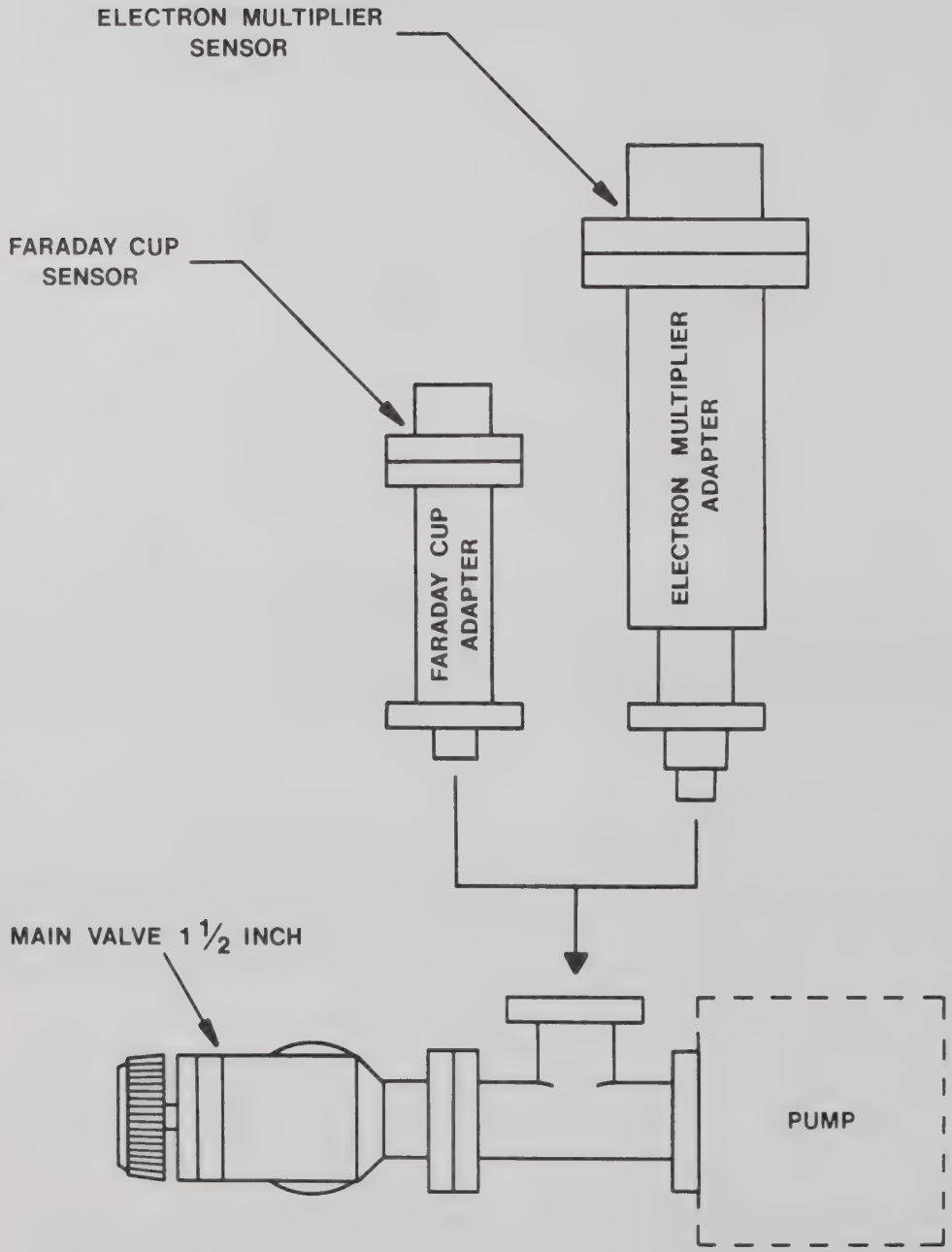


Figure 2 - Alternate Mounting Arrangement



a. Make sure copper gaskets and sealing surfaces are clean and free from contaminants.

b. DO NOT reuse copper gaskets.

c. Lubricate the bolt threads with an anti-seize compound (such as Fel-Pro® C-100) especially if bake-out will be required.

d. Align the flanges properly so that the gasket fits into the recesses in both flanges and they are parallel.

e. Tighten bolts gradually and evenly, in a crisscross pattern, until flange faces come into contact.

2. Connect the ion pump (if ordered) to the IPC-2 assembly, using six of the ¼ - 28 bolts and nuts supplied. Insert the pump restrictor gasket between the IPC-2 flange and the ion pump flange, instead of a standard gasket. Apply lubricant to bolt threads and tighten as instructed above. (Refer to ion pump manual for further instructions.)

CAUTION:	It is important to support the weight of the ion pump to avoid excessive stress on the flanges and weld joints of the IPC-2 or the vacuum system.

3. The turbo pump system (if ordered) is assembled as follows: (Review the Turbovac® 150 Manual before installation)

a. Using the large copper gasket (6") with the turbo pump, attach the 6" to 2-3/4" Adapter Flange (IPN 012-360) to the inlet of the Turbo Pump (IPN 012-357). The sixteen 5/16 - 24 x 2" screws and nuts in the Turbo Installation Parts Kit are for this purpose. Follow ConFlat® flange instructions given on p. 2.

b. Connect the turbo pump to the IPC-2 Assembly using the six ¼ - 28 x 7/8" screws supplied with the turbo pump. Insert the pump restrictor gasket between the flange of the IPC-2 assembly and the adapter flange on the turbo pump. The turbo pump may be mounted in any position and should be oriented for optimum ease of connection of the power cable, water lines and backing pump vacuum line and venting device assembly. Tighten according to ConFlat® flange instructions.

CAUTION:	It is important to support the weight of the turbo pump to avoid excessive stress on the flanges and weld joints of the IPC-2 or the vacuum system.

c. The inert gas Venting Device Assembly is attached to the turbo pump outlet by means of the KF25 clamp and seal supplied with the pump. Be careful to orient the small tube of the venting device so that it is pointing upward into the pump body and does not impinge against the walls of the outlet opening. See Figure 10, Page 20.

Attach a low pressure (3 to 5 PSIG) supply of dry inert or noble gas such as nitrogen or argon to the inlet (1/8" NPT) of the solenoid valve of the venting device assembly. Connect the solenoid valve power cord to a convenient 110/120 VAC outlet.

d. A suitable backing pump must be connected to the large (KF25) flange of the venting device. The backing system must provide a low pressure ($p < 50$ mtorr) at the turbo pump discharge when the turbo pump is running.

If the backing pump kit is ordered, install it as follows: Connect the large flange (KF25) of the venting device to the inlet of the D2A Rotary Vane Pump (IPN 012-379) using the PVC Hose Assembly (IPN 012-359) and KF 25/16 Reducer (IPN 012-377). A KF25 Elbow (IPN 012-374) is included for use if needed to improve the routing of the hose.

Attach the Smoke Eliminator (IPN 012-378) to the discharge connection flange of the pump.

Connect the rotary vane pump power cord to a 110/120 VAC 60 Hz outlet. Review the rotary pump instruction manual before operating. Check the oil level in the pump. The recommended replacement oil for this pump is HE-200, available from Leybold-Heraeus Vacuum Products.

CAUTION:	**When installing the backing pump and associated accessories do not put additional mechanical stress on the turbo pump and the IPC-2 assembly.**

e. A water supply and drain line must be connected to the turbo pump. Recommended flow is approximately 8 GPH and may be in either direction through the pump. (See Turbovac® 150 Manual) Refer to the Air Cooler Installation Instructions (pages 22-25), if you have the air cooler option.

f. Note that in the event of a power failure, the turbo pump does NOT re-start automatically, whereas the backing pump will immediately resume operation after restoration of power - which

could result in oil vapor backstreaming into the turbo pump, the IPC-2, and Inficon quadrupole sensor. For automatic starting after resumption of power, a jumper must be added to the terminal block on the rear of the NT 150/360 Frequency Converter. Review the operating manual for the NT 150/360.

If the system is to run unattended, install provisions for automatic restart.

For additional protection against oil vapor backstreaming, attach a molecular sieve trap to the foreline of the backing pump.

4. Install the Inficon quadrupole sensor in the IPC-2 assembly using the remaining six bolts and 2-3/4" copper gasket as shown in Figure 2. Apply thread lubricant and tighten bolts according to ConFlat® flange instructions. Orient the sensor in a position that best facilitates attachment of the interconnecting cables to the Inficon quadrupole control unit and RF unit.

CAUTION:	**Be very careful when inserting the sensor into the IPC-2 assembly to avoid damaging the ion source structure on the tip of the sensor.**

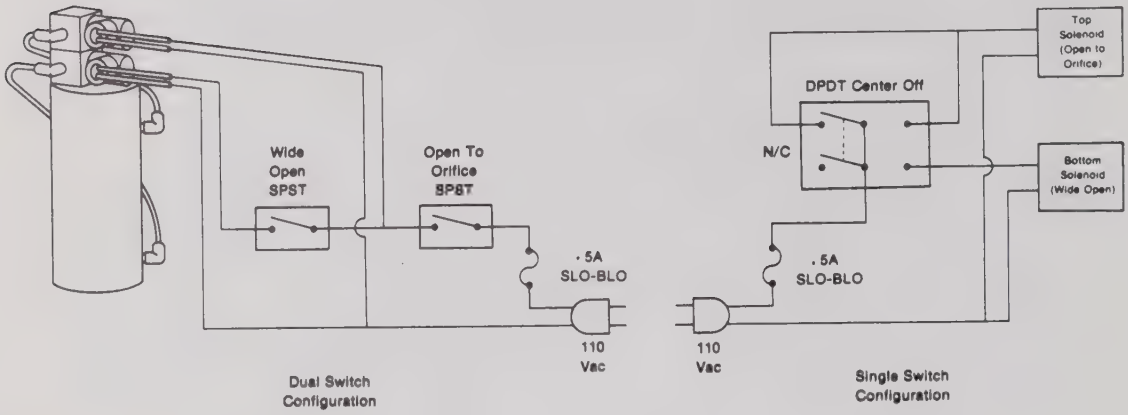
5. If the IPC-2 is supplied with electropneumatic valves, connect the air supply to both control solenoids and observe the following precautions:

   a. Do not exceed 190°C temperature (of the IPC-2) or the valve actuating mechanisms may be damaged.

   b. Minimum air pressure should not be less than 50 PSIG. Do not exceed 125 PSIG air pressure or actuators will be damaged.

   c. Wire the control solenoids to a source of line voltage (120 VAC) as illustrated in Figure 3.

Figure 3 - Solenoid Wiring Diagram



■ REPLACING THE ORIFICE

▮Manual Valve Instructions

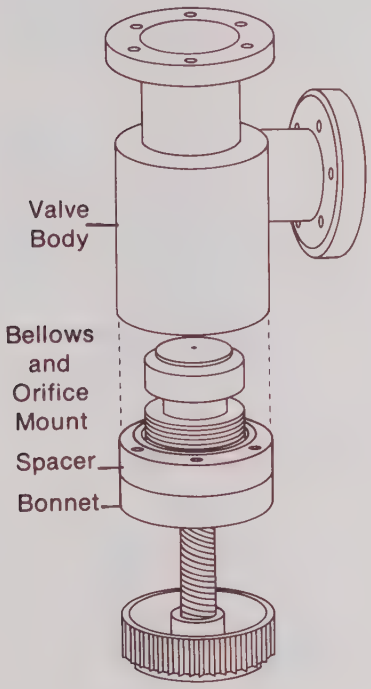
The entire vacuum system must be at atmosphere to replace the orifice. It is not necessary to remove the outer valve body from the system. However,

1. Open the valve to the fully open position by pulling the spring loaded detent and opening the valve completely.

2. Using a 5/32 right angle Allen wrench, remove the 6 screws that fasten the valve bonnet to the outer valve body.

3. Grasping the valve body spacer with the valve bonnet, take the inner valve assembly from within the valve body (Figure 4).

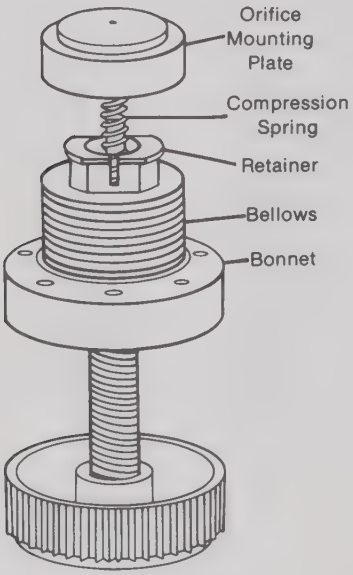
Figure 4 - Manual Valve Assembly Removed



CAUTION: Use clean, lint-free gloves and tweezers to avoid system contamination. Avoid rubber gloves as they may cause talcum contamination.

4. Hold the bellows laterally. Gently push and rotate the orifice mount 1/4 turn to remove it (Figure 5).

Figure 5 - Orifice Mount Removed



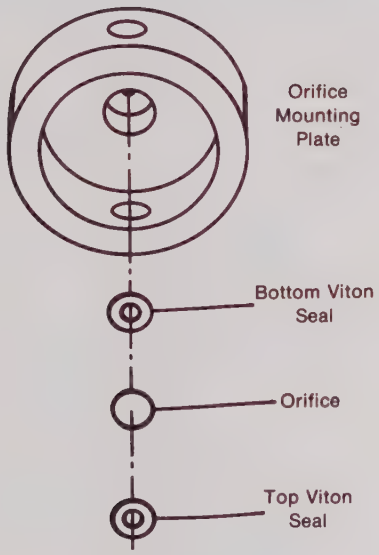
5. Set the inner valve assembly and spring aside on a clean surface.

6. Remove the top Viton® seal from the orifice plate. If the orifice plate sticks to the bottom Viton® seal, use a soft, blunt rod (tightly rolled piece of paper will do) to free the plate from beneath.

NOTE: Orifices may be reused if they are stored away from contaminants. DO NOT attempt to use an orifice which has become bent or deformed in handling, as it will not seal properly.

7. New orifice sets are shipped with both seals included. Place the bottom seal in the insert and center it before the orifice plate is installed, followed by the top seal and the washer (see Figure 6).

Figure 6 - Seal Installation



8. With the main spring on the plunger of the inner valve assembly, insert the retainer laterally into the orifice mount, so that the fins on the retainer clear the pins and the spring is seated on the seal. Push in the spring and rotate the mount 1/4 turn, aligning the slot in the retainer with the hole in the mount.

■ Electropneumatic Valve Instructions

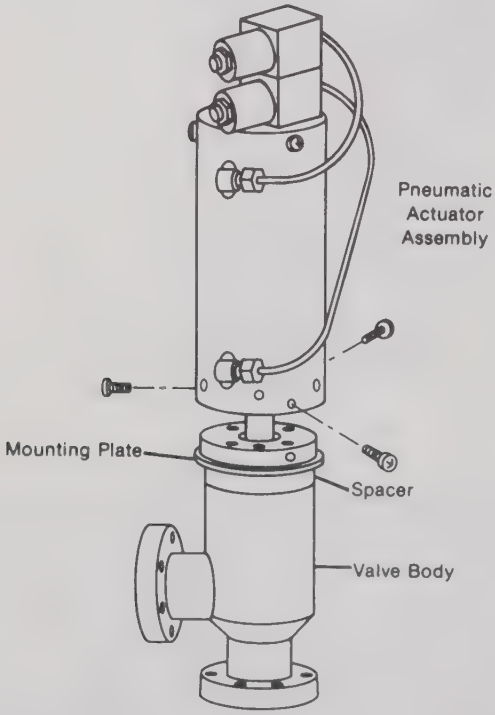
The entire vacuum system must be at atmosphere. It is not necessary to remove the outer valve from the system. You may wish to disconnect the air and power lines to the solenoid valves; in any event, make sure the power is off before disassembling the valve. You must either disconnect the air and power lines from the solenoids or remove the solenoid manifold assembly, with its air lines, from the cylinder.

1. Support the cylinder and push it (with over 35 lbs. of force) towards the valve body while removing the three screws fastening the bottom of the cylinder support to the valve body.

2. While supporting the air cylinder assembly, unscrew the entire assembly from the valve body (about 10 turns). Make a note of the mounting plate orientation and remove the six screws fastening the mounting plate to the valve body with a 7/32" Allen wrench.

3. Carefully pull the entire inner valve assembly (with the cylinder assembly) out of the valve body, grasping the valve body spacer with the cylinder mounting plate (Figure 7).

Figure 7 - Electropneumatic Valve Assembly Removed



4. Hold the bellows laterally. Gently push and rotate the orifice mount 1/4 turn to remove it (refer to Figure 4).

5. Set the inner valve assembly and spring aside on a clean surface.

6. Remove the top Viton® seal from the orifice plate. If the orifice plate sticks to the bottom Viton® seal, use a soft, blunt rod type instrument (a tightly rolled piece of paper will do) to free the plate from beneath.

NOTE: Orifices may be reused if they are stored away from contaminants. DO NOT attempt to use an orifice which has become bent or deformed in handling, as it will not seal properly.

7. New orifice sets are shipped with both seals included. Place the bottom seal in the insert and center it before the orifice plate is installed, followed by the top seal and the washer (see Figure 6).

8. With the main spring on the plunger of the inner valve assembly, insert the retainer laterally into the orifice mount, so that the fins on the retainer clear the pins and the spring is seated on the seal. Push in the spring and rotate the mount 1/4 turn, aligning the slot in the retainer with the hole in the mount.

9. Set the valve body spacer ("O ring") in its' recess and place the inner valve assembly in the valve body. Align the holes and insert the screws in the cylinder mounting plate. Tighten with the right angle Allen wrench.

10. Thread the cylinder assembly onto the rod adapter inside the valve body about 10 turns. Back off the thread to obtain the correct position for the cylinder mounting holes and its orientation.

■ OPERATION

▮Start-up With Ion Pump

Review the enclosed Ion Pump Manual before carefully attempting to operate this system.

A. From Atmospheric Pressure In The Ion Pump

After assembling the IPC-2, or opening it up for maintenance work, evacuate to a level at which the ion pump can be started. Use the vacuum system of the process chamber for this purpose.

1. Prior to evacuating the process chamber, open the valve to the detent orifice position; then, pull the detent plunger and (continuing to turn) open to the full-open position.

CAUTION:	**The valves should not be opened into a chamber that is already under vacuum, or the resulting rush of air may carry particles into the orifice and plug it.**

2. Pump down the process chamber to 2×10^{-2} torr or lower. Allow 5 or 10 minutes to outgas the IPC-2 assembly.

3. Close the valve to the full-closed position, and start the ion pump according to the instructions in the manufacturer's manual (attached).

4. If the ion pump fails to start, turn it off and open the valve to the full-open position, for 10-15 minutes to allow further degassing. Then, reclose the valve and repeat the starting procedure.

B. From High Vacuum In The Ion Pump

1. Evacuate the process chamber before opening the IPC-2 valve.

2. Start the ion pump according to the manufacturer's instructions.

3. If the ion pump will not start, evacuate the process chamber to 2×10^{-2} torr or lower, open the valve to the full-open position, and allow 10-15 minutes for the pump to outgas. Then, re-close the valve to the full-closed position and repeat the starting procedure.

■ **Start-up With Turbo-Molecular Pump**

Please, review the enclosed Turbovac® 150 Manual before attempting to operate this system.

1. Tightly close the IPC-2 valve.

2. Turn on the cooling water for the turbo pump or turn on air cooler option.

3. Turn on the rotary vane backing pump and push the "START" button on the turbo pump power supply. The "acceleration" light on the front panel should be illuminated.

4. After about 1½ to 2 minutes the "Normal Operation" light should come on, indicating that the turbo pump is up to normal running speed. If this fails to occur it is indicative of a problem, such as:

   - Incomplete electrical cable connection. Recheck.
   - A large air or gas leak into the system. Re-check tightness of flange screws where attached to the system and the flange on the top of the turbo pump. Make certain IPC-2 valve is tightly closed.
   - Poor backing system pressure. Check both pump and connections.
   - Solenoid valve in the venting device assembly is stuck open or leaking.

Read Section 9, "Trouble Shooting", in Turbovac® 150 Manual for a more detailed discussion of possible problems and their analysis.

CAUTION:	**Operating the rotary vane pump without operating the turbo pump can result in exposure of the Inficon quadrupole to oil vapors, resulting in contamination and possible reduced life of the sensor.**

■ Gas Analysis

The IPC-2 permits gas analysis in two modes:

High Vacuum — This mode is to be used only when the process chamber is at high vacuum (10^{-5} torr or less). The pressure in the IPC-2 is the same as in the process chamber. It is not mandatory that the IPC-2 Ion Pump be in operation at this time; however, the Turbo pumped IPC-2 systems must be in operation or the process chamber vacuum will draw vapors through the roughing system, into the turbo exhaust port, and subsequently into the process chamber.

Low Vacuum — This mode is to be used when the process chamber pressure is between 10^{-5} torr and the maximum pressure limit for the orifice in use (See Figure 8). The pressure in the IPC-2 is proportional to the process chamber pressure, but is reduced to a level suitable for a gas analyzer.

Operating conditions for the respective modes are as follows:

	Pressure Mode	
	High Vacuum	Low Vacuum
Full Open Position	Used	Unused
Orifice Position	Unused	Used
Ion Pump	Either	Used
Turbo Pump	Used	Used

■ Shut Down

With Ion Pump

Before venting the process chamber, close the valve on the IPC-2. Tightening by hand will be sufficient.

NOTE: If convenient, the ion pump can be left on since the gas load will be small, or you can turn off the ion pump and the Inficon quadrupole, leaving the IPC-2 under vacuum.

With Turbo Pump

Turn off the Inficon quadrupole and close the IPC-2 valve. Turn off the backing pump and press the "stop" button on the turbo pump power supply to turn off the turbo pump.

Immediately actuate the momentary switch on the line cord going to the solenoid valve on the venting device. Hold the switch in the "ON" position for about 5 to 10 seconds, venting the system with inert gas which floods the system and also flows into the interconnections between the turbo and backing pumps to suppress any possible backstreaming of oil vapors from the backing pump into the turbo pump and IPC-2.

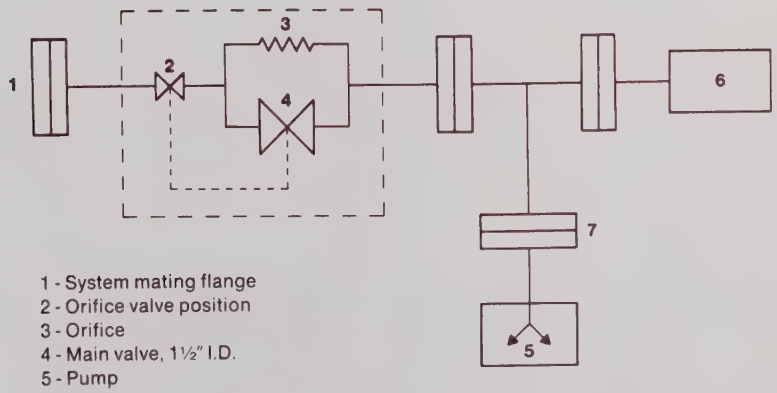
This procedure also helps to prevent contamination of the quadrupole sensor due to exposure to air and moisture.

THEORY OF OPERATION

The IPC-2 is designed for analysis of gases at pressures which are too high for direct exposure to the Inficon quadrupole gas analyzer sensor. In this case, the IPC-2 reduces the partial pressures of each of the components in the gas mixture by a fixed proportion, prior to analysis.

The pressure reduction is accomplished by the "double-molecular-leak" method. As shown in Figure 8, gas molecules from the process chamber (vacuum system) are admitted through the control orifice (3) to the measuring volume containing the quadrupole sensor (6). Simultaneously, gas molecules are escaping from the measuring volume through the restrictor (7) to the pump (5). Under steady state conditions, such a system produces a fixed ratio between the pressure at point (1) and the pressure at point (6). The pressure ratio is equal to the ratio of the pumping speed, controlled by the restrictor gasket (7), to the conductance of orifice (3).

Figure 8 - Vacuum Schematic



1 - System mating flange
2 - Orifice valve position
3 - Orifice
4 - Main valve, 1½" I.D.
5 - Pump
6 - Sensor
7 - Restrictor

NOTE: All flanges 2 ¾" ConFlat® except where noted.

STANDARD ORIFICE/GASKET PRESSURE RANGES

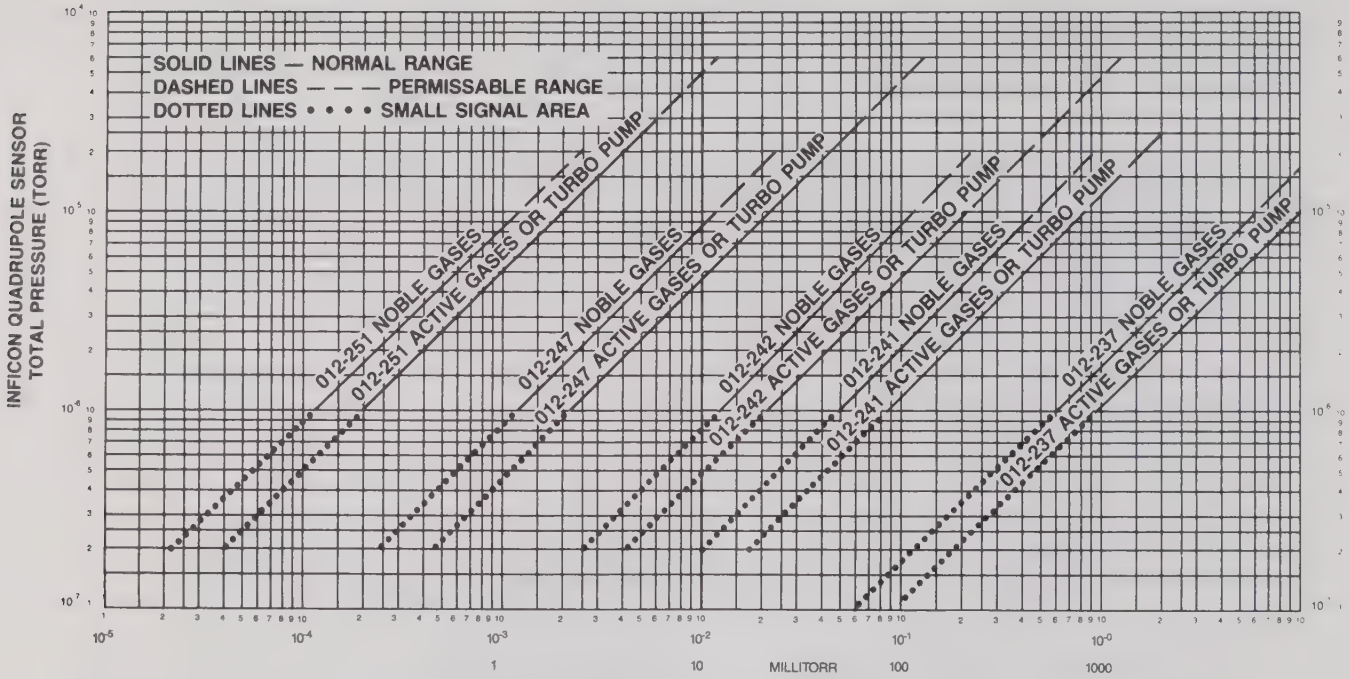

SOLID LINES — NORMAL RANGE
DASHED LINES — — — PERMISSABLE RANGE
DOTTED LINES • • • • SMALL SIGNAL AREA
012-251 NOBLE GASES
012-251 ACTIVE GASES OR TURBO PUMP
012-247 NOBLE GASES
012-247 ACTIVE GASES OR TURBO PUMP
012-242 NOBLE GASES
012-242 ACTIVE GASES OR TURBO PUMP
012-241 NOBLE GASES
012-241 ACTIVE GASES OR TURBO PUMP
012-237 NOBLE GASES
012-237 ACTIVE GASES OR TURBO PUMP
INFICON QUADRUPOLE SENSOR TOTAL PRESSURE (TORR)
MILLITORR
PROCESS CHAMBER TOTAL PRESSURE TORR

Fig. 9.1 - IPC-2 Pressure Conversion Chart with Orifice Part Numbers

CHART

HIGH FLOW ORIFICE/GASKET PRESSURE RANGES

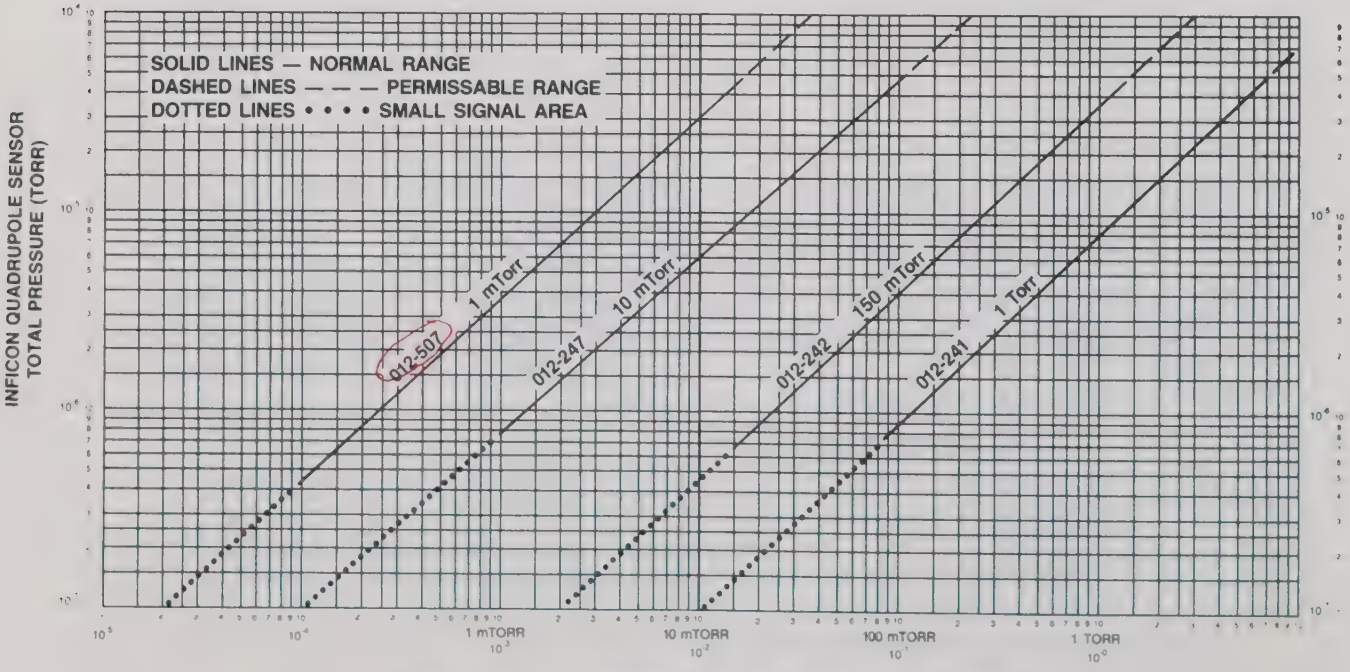


Fig. 9.2 Turbo Pumped Pressure Conversion Chart with Orifice Part Numbers

The relationship between the process chamber pressure and the pressure in the measuring volume of the IPC-2 is given by the Pressure Conversion Chart (Figure 9). In this chart, lines are given for several orifice sizes, (1 millitorr, 10 millitorr, 150 millitorr, 1 torr, and 10 torr). When using an ion pump, a given orifice will produce the same ratio with all gases, except noble gases (argon, helium, etc.). Since the ion pump speed, for noble gases, is not sufficient to produce the full pressure ratio, a second characteristic line is given for these gases. When using a turbo pump, all gas species are pumped at the same speed.

The dashed lines on the chart indicate a pressure at which the lifetime of the ion pump may be decreased. A more detailed discussion of ion pump lifetime is included in the ion pump manual. If operated above the maximum pressure, the ion pump may overheat which will cause the ion pump to outgas faster than it pumps. This is a thermal runaway situation which will result in an automatic shutdown of the ion pump. Catastrophic failure will probably not occur, but permanent damage (to some degree) will result.

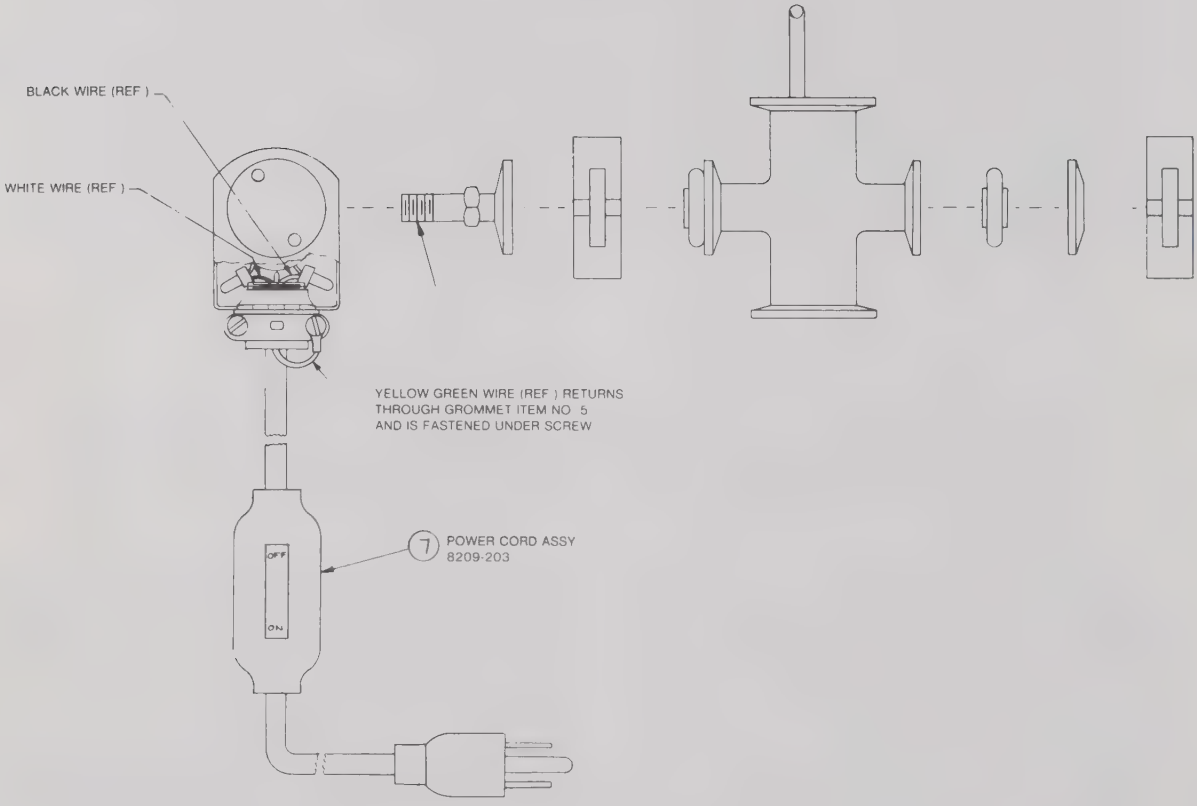
■ MAINTENANCE

Two items in the IPC-2 require periodic maintenance. The turbo pump (TMP 150) bearings require grease lubrication every 3000 hours of operation. Review Section 7 of the Turbo Pump Operating Instructions. Also, the level of oil in the backing pump must be checked regularly. Review Section 9 of the Backing Pump Operating Instructions.

The following manuals are supplied with the IPC-2:

- Ion Pump Instructions
- Turbo Pump Operating Instructions and Spare Parts List
- Frequency Converter Operating Instructions and Spare Parts List
- Backing Pump Operating Instructions and Spare Parts List

Figure 10 - Venting Device Assembly



■ HEATING JACKET INSTRUCTIONS

The heating jacket consists of three parts (Figure 11):

(1) Sensor mantle
(1) IPC-2 valve mantle
(1) "Tee" insulator

Figure 11 - Heating Jacket

Install the sensor mantle so that the mantle does not protrude over the plastic connector, nor come into contact with anything that will melt or burn when the heating jacket is in use.

CAUTION:	DO NOT restrict ambient air from cooling the connector, impeded air circulation may cause the connector to melt.
WARNINGS:	Metal surface can become dangerously hot.

The mantle for the IPC-2 manual valve should not protrude over the detent handle. You may choose to lift the detent handle with a screwdriver blade when the heating mantle is operating. The mantle for the IPC-2 electropneumatic version should not protrude over the cylinder.

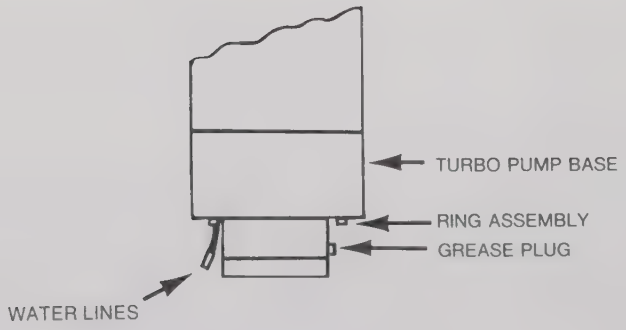
CAUTION:	**Restricting ambient air from cooling the electropneumatic air cylinder may cause damage to the seals inside the cylinder.**

Check to make sure that the heater uniformly fits around the part it was made to heat. Air gaps between the surface of the heater and the part to be heated create hot spots and this may result in heater failure. For proper temperature control, find the location of the thermostat and use the fiberglass lacing to firmly couple it to the metal of the part to be heated. Also use the lacing to contour the jacket around the part to eliminate air gaps.

■ AIR COOLER INSTALLATION INSTRUCTIONS

The air cooler assembly is used on the IPC-2 Pressure Converters which have the Turbo Pump option. This simple cooling mechanism offered as a viable alternative to the water cooling method.

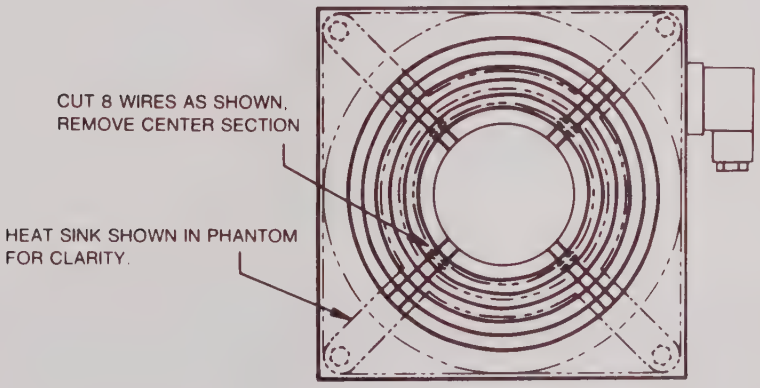
Figure 12 - Turbo Pump Base



1. On the base of the turbo pump (Figure 12), the water coolant ring assembly is secured by three (3mm) socket head screws. Disconnect ring assembly from turbo pump base by unscrewing these three screws and removing the ring assembly. Remove the lower grease plug (requires a 5mm allen wrench) identified on Figure 12. Set the water tube and ring assembly aside along with the screws. Store them; they won't be needed for this assembly. Remove the turbo pump legs.

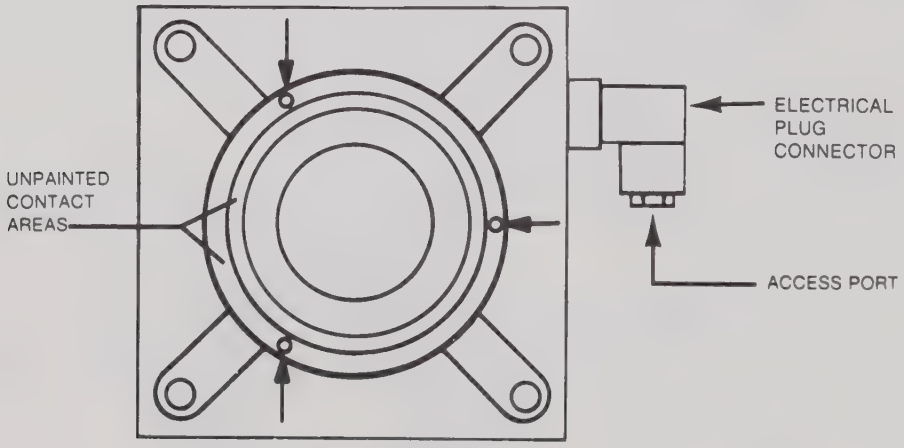
2. Cut and remove the center section of the top protective guard (wire screen) on the air cooler, as it interferes with the bottom of the TMP 150 turbo pump. This is accomplished with wire cutters, see Figure 13. Although this modification is not necessary for the air-cooled TMP 120; the modified air-cooler will fit both the TMP 150 and the TMP 120.

Figure 13 - Screen Removal



3. Next, place the air cooler on the pump and examine the fit and the screw hole alignment.

Figure 14 - Air Cooler - Top View



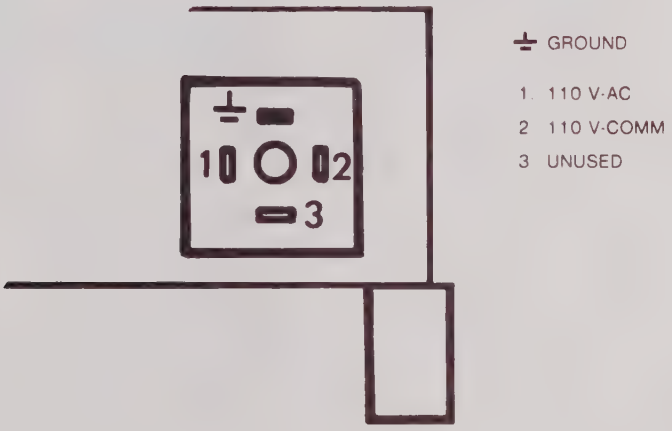
4. In Figure 14, arrows point to the 3 holes where the enclosed screws attach the air cooler to the turbo pump base, similar to the water coolant ring assembly. (A nutdriver with long extension will make assembly much easier). The turbo pump base fits securely into the top of the air cooler ring. Do not over-tighten screws. Replace the grease plug removed in step #1.

5. Install a 110V line cord (not included with IPN 012-400) to the plug connector as follows:

a. Remove the screw from the side of the plug connector (see Figure 15). Gently remove the plug by pulling away from pump. Using a small screwdriver or pencil head, insert into the access port and pry the female connector head outward. (It is not necessary to remove the threaded strain relief unless the access port will not accommodate the wiring.)

b. Push the wires into the access port and out through the connector head opening. Wire the connector head per Figure 15.

Figure 15 - Air Cooler Wiring Configuration



c. Snap the connector head back into place in the plug connector. (Screw in the threaded strain relief if it was disassembled.) Return the plug connector to its original position on the air cooler. Tighten the screw.

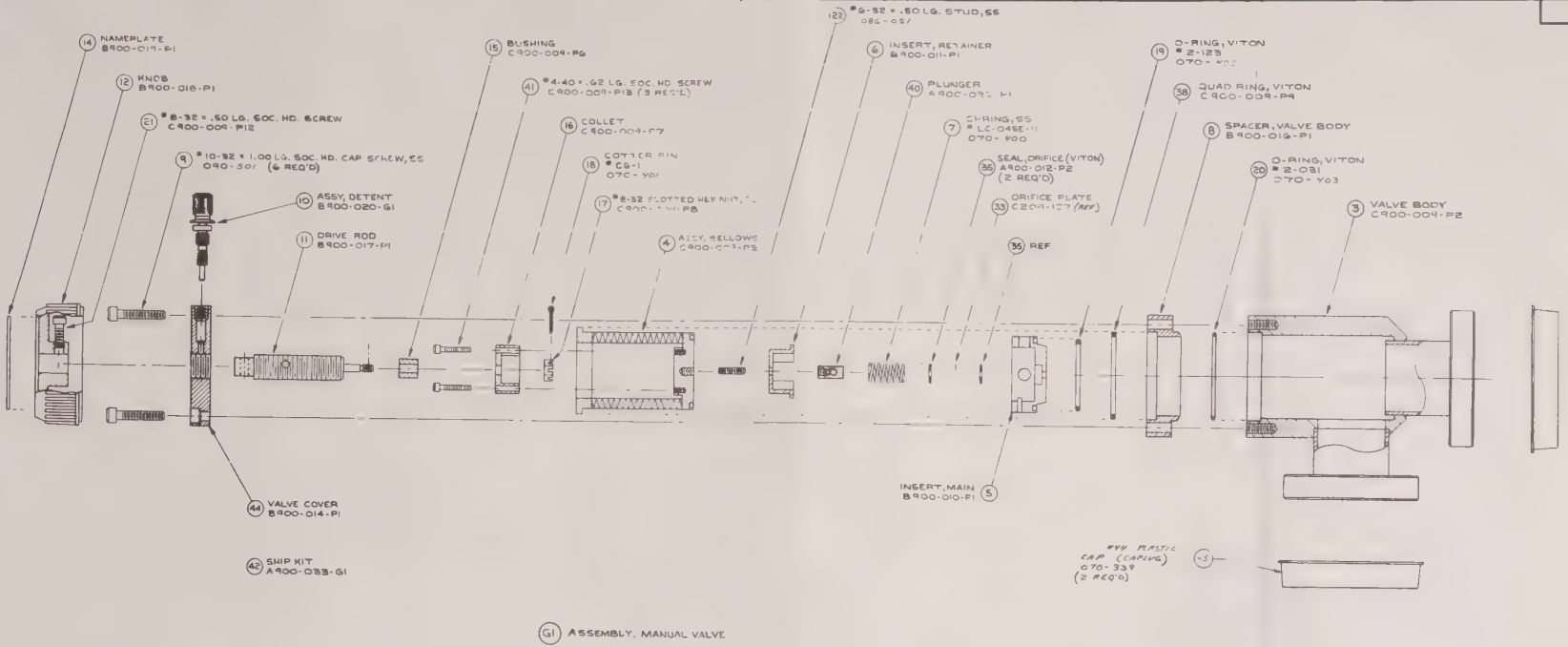
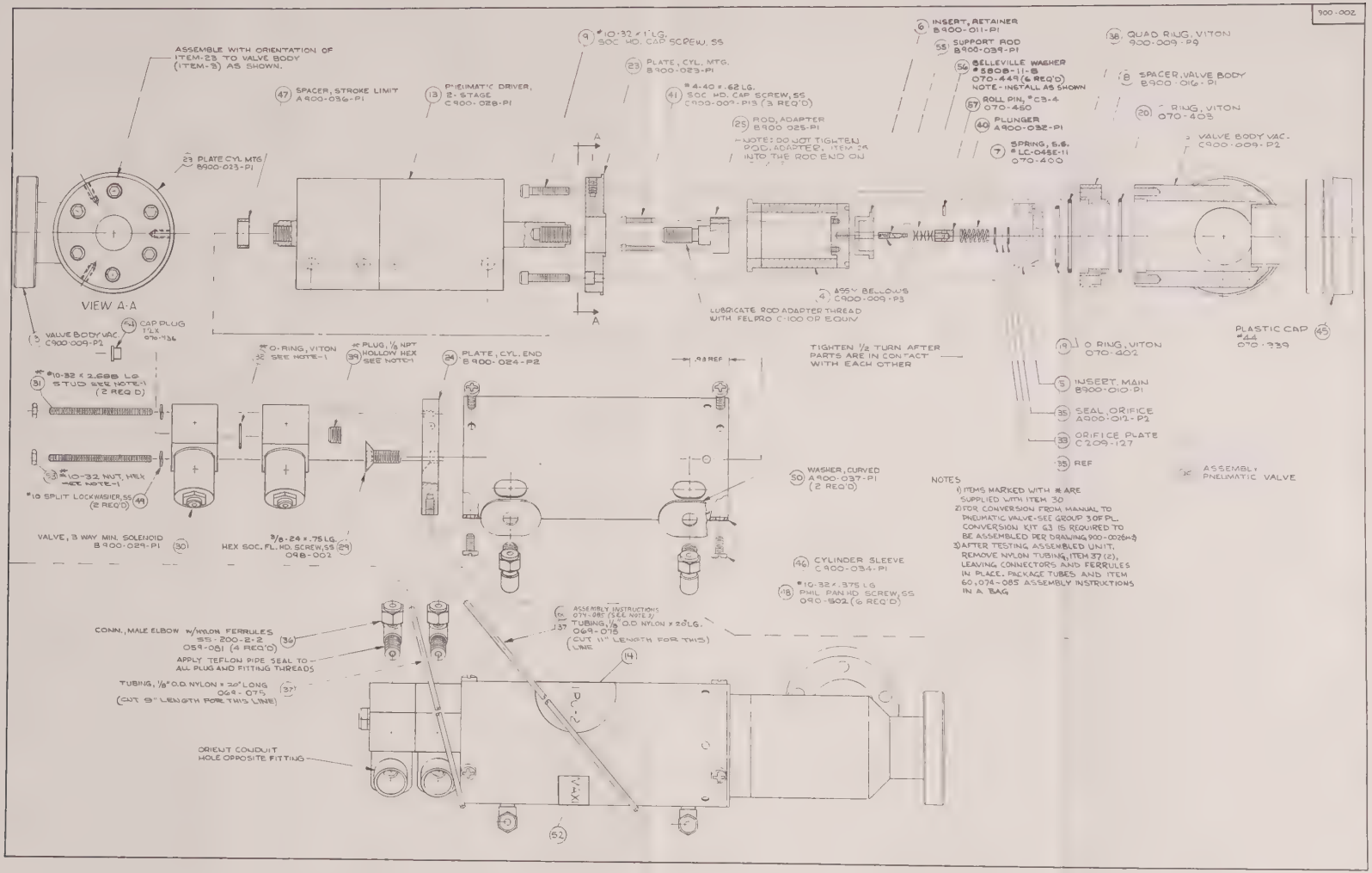

14 NAMEPLATE B900-019-P1
12 KNOB B900-018-P1
E1 #8-32 x .50 LG. SOC. HD. SCREW C900-009-P12
9 #10-32 x 1.00 LG. SOC. HD. CAP SCREW, SS 090-501 (6 REQ'D)
10 ASSY, DETENT B900-020-G1
11 DRIVE ROD B900-017-P1
44 VALVE COVER B900-014-P1
42 SHIP KIT A900-033-G1
15 BUSHING C900-009-P6
41 #4-40 x .62 LG. SOC. HD. SCREW C900-009-P13 (3 REQ'D)
16 COLLET C900-009-P7
18 COTTER PIN #CG-1 070-401
17 #8-32 SLOTTED HEX NUT, SS C900-009-P8
4 ASSY. BELLOWS C900-003-P2
22 #6-32 x .50 LG. STUD, SS 086-051
6 INSERT, RETAINER B900-011-P1
40 PLUNGER A900-031-P1
7 SPRING, SS #LC-045E-11 070-400
36 SEAL, ORIFICE (VITON) A900-012-P2 (2 REQ'D)
33 ORIFICE PLATE C209-127 (REF)
35 REF
INSERT, MAIN B900-010-P1 5
19 O-RING, VITON #2-123 070-402
38 QUAD RING, VITON C900-009-P9
8 SPACER, VALVE BODY B900-016-P1
20 O-RING, VITON #2-031 070-403
3 VALVE BODY C900-009-P2
6YY PLASTIC CAP (CAPLUG) 070-339 (2 REQ'D) 45
G1 ASSEMBLY, MANUAL VALVE

Figure 16 - IPC-2 Assembly (Exploded Drawing)


900-002
ASSEMBLE WITH ORIENTATION OF ITEM-23 TO VALVE BODY (ITEM-3) AS SHOWN.
(47) SPACER, STROKE LIMIT A900-036-P1
(13) PNEUMATIC DRIVER, 2-STAGE C900-028-P1
(9) #10-32 x 1" LG. SOC HD. CAP SCREW, SS
(23) PLATE, CYL. MTG. B900-023-P1
(41) #4-40 x .62 LG. SOC HD. CAP SCREW, SS C900-009-P13 (3 REQ'D)
(25) ROD, ADAPTER B900-025-P1
NOTE: DO NOT TIGHTEN 900-ADAPTER, ITEM 24 INTO THE ROD END ON
(6) INSERT, RETAINER B900-011-P1
(55) SUPPORT ROD B900-039-P1
(56) BELLEVILLE WASHER #5808-11-B 070-449 (6 REQ'D) NOTE - INSTALL AS SHOWN
(57) ROLL PIN, #CB-4 070-450
(40) PLUNGER A900-032-P1
(7) SPRING, S.S. #LC-045E-11 070-400
(38) QUAD RING, VITON 900-009-P9
(8) SPACER, VALVE BODY B900-016-P1
(20) O RING, VITON 070-403
(3) VALVE BODY VAC. C900-009-P2
(23) PLATE CYL MTG B900-023-P1
VIEW A-A
(54) CAP PLUG T/LX 070-136
(3) VALVE BODY VAC. C900-009-P2
(4) ASSY BELLOWS C900-009-P3
LUBRICATE ROD ADAPTER THREAD WITH FELPRO C-100 OR EQUIV
(32) O-RING, VITON SEE NOTE-1
(39) PLUG, 1/8 NPT HOLLOW HEX SEE NOTE-1
(24) PLATE, CYL. END B900-024-P2
.93 REF
TIGHTEN 1/2 TURN AFTER PARTS ARE IN CONTACT WITH EACH OTHER
(19) O RING, VITON 070-402
(5) INSERT, MAIN B900-010-P1
(35) SEAL, ORIFICE A900-012-P2
(33) ORIFICE PLATE C209-127
(34) REF
PLASTIC CAP #44 070-339
(31) #10-32 x 2.688 LG. STUD SEE NOTE-1 (2 REQ'D)
(33) #10-32 NUT, HEX HEX NOTE-1
#10 SPLIT LOCKWASHER, SS (2 REQ'D) (44)
VALVE, 3 WAY MIN. SOLENOID B900-029-P1 (30)
3/8-24 x .75 LG. HEX SOC. FL. HD. SCREW, SS 098-002 (29)
(50) WASHER, CURVED A900-037-P1 (2 REQ'D)
(46) CYLINDER SLEEVE C900-034-P1
(18) #10-32 x .375 LG. PHIL PAN HD SCREW, SS 090-502 (6 REQ'D)
ASSEMBLY PNEUMATIC VALVE
NOTES
1) ITEMS MARKED WITH # ARE SUPPLIED WITH ITEM 30
2) FOR CONVERSION FROM MANUAL TO PNEUMATIC VALVE - SEE GROUP 3 OF PL. CONVERSION KIT G3 IS REQUIRED TO BE ASSEMBLED PER DRAWING 900-002G-3
3) AFTER TESTING ASSEMBLED UNIT, REMOVE NYLON TUBING, ITEM 37 (2), LEAVING CONNECTORS AND FERRULES IN PLACE. PACKAGE TUBES AND ITEM 60,074-085 ASSEMBLY INSTRUCTIONS IN A BAG
CONN., MALE ELBOW w/NYLON FERRULES SS-200-2-2 059-081 (4 REQ'D) (36)
APPLY TEFLON PIPE SEAL TO ALL PLUG AND FITTING THREADS
TUBING, 1/8" O.D. NYLON x 30" LONG 069-075 (37) (CUT 9" LENGTH FOR THIS LINE)
(1x) ASSEMBLY INSTRUCTIONS 074-085 (SEE NOTE 3)
(37) TUBING, 1/8 O.D. NYLON x 28 LG. 069-075 (CUT 11" LENGTH FOR THIS LINE)
(14)
ORIENT CONDUIT HOLE OPPOSITE FITTING
(52)

Pg 26A

Figure 16A-IPC-2 Assembly (Exploded Drawing)

Sht 2 of 2

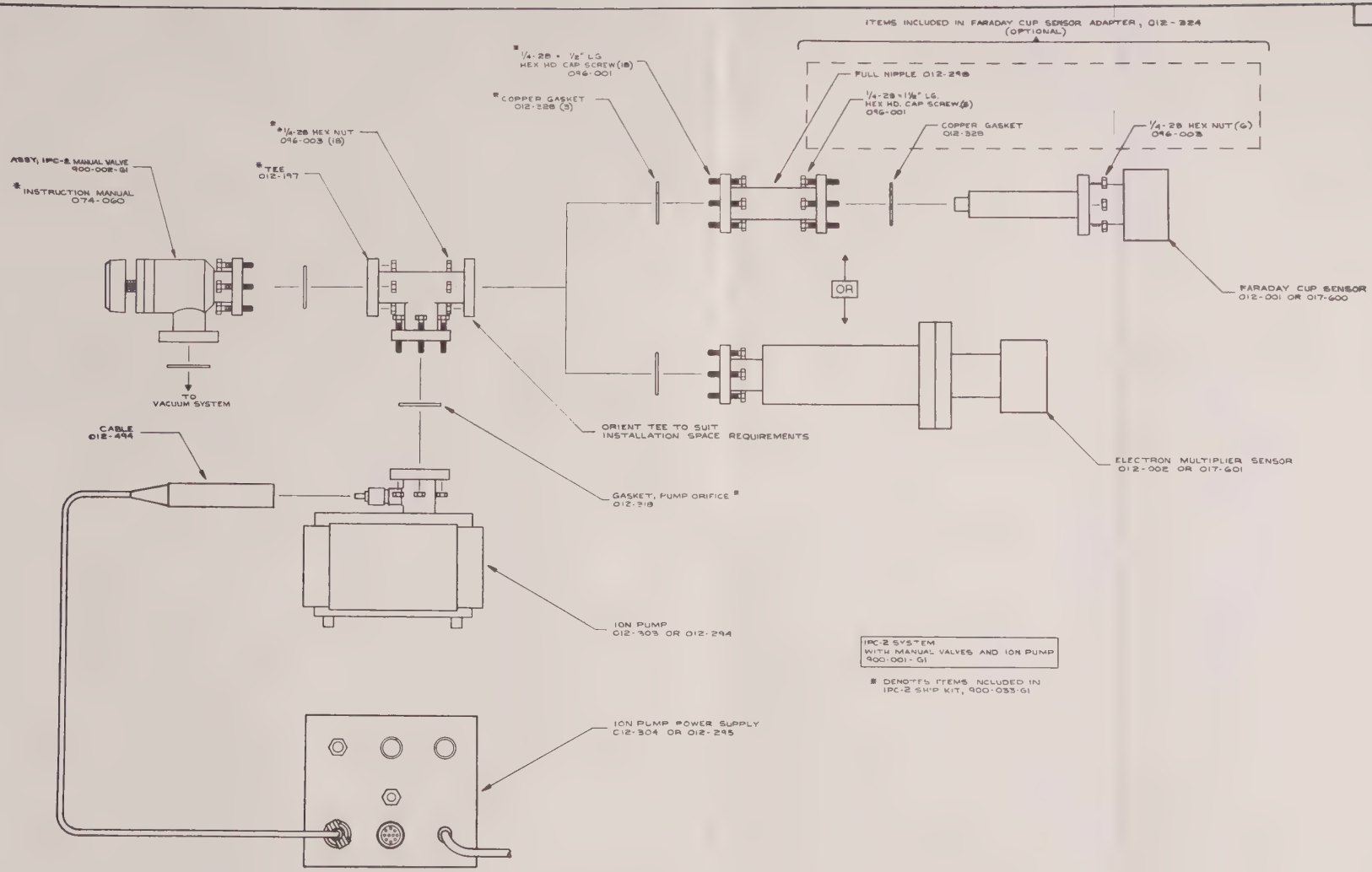

ITEMS INCLUDED IN FARADAY CUP SENSOR ADAPTER, 012-324 (OPTIONAL)
*1/4-28 x 1/2" LG HEX HD CAP SCREW (18) 096-001
FULL NIPPLE 012-298
*COPPER GASKET 012-328 (3)
1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (6) 096-001
COPPER GASKET 012-328
*1/4-28 HEX NUT 096-003 (18)
1/4-28 HEX NUT (6) 096-003
ASSY, IPC-2 MANUAL VALVE 900-002-G1
*INSTRUCTION MANUAL 074-060
*TEE 012-197
OR
FARADAY CUP SENSOR 012-001 OR 017-600
TO VACUUM SYSTEM
ORIENT TEE TO SUIT INSTALLATION SPACE REQUIREMENTS
ELECTRON MULTIPLIER SENSOR 012-002 OR 017-601
CABLE 012-494
GASKET, PUMP ORIFICE * 012-318
ION PUMP 012-303 OR 012-294
IPC-2 SYSTEM WITH MANUAL VALVES AND ION PUMP 900-001-G1
* DENOTES ITEMS NCLUDED IN IPC-2 SHIP KIT, 900-033-G1
ION PUMP POWER SUPPLY 012-304 OR 012-295

Figure 17 - IPC-2 System w/Manual Valve and Ion Pump

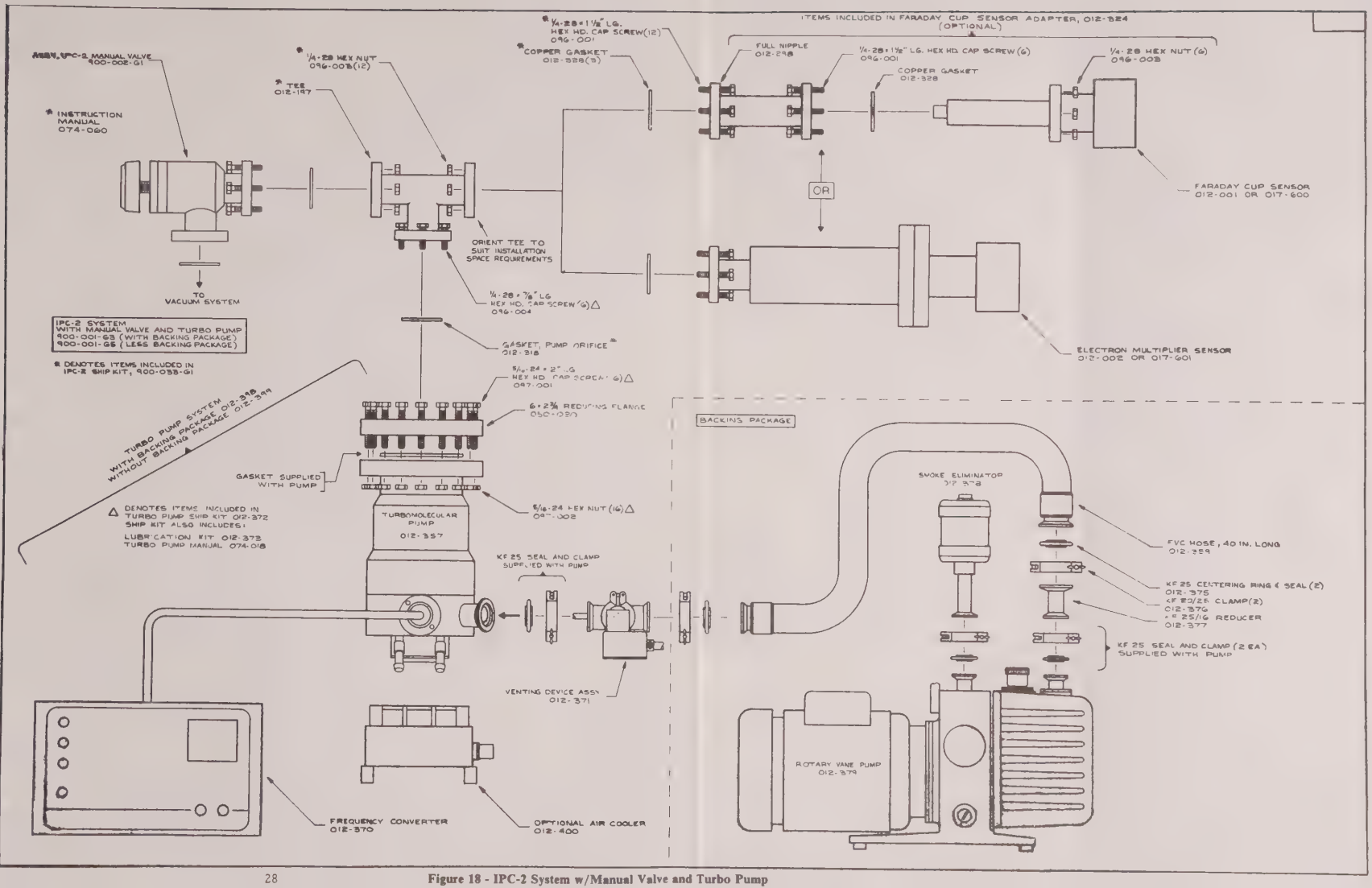

ITEMS INCLUDED IN FARADAY CUP SENSOR ADAPTER, 012-324 (OPTIONAL)
* 1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (12) 096-001
* COPPER GASKET 012-328 (3)
FULL NIPPLE 012-298
1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (6) 096-001
COPPER GASKET 012-328
1/4-28 HEX NUT (6) 096-003
* 1/4-28 HEX NUT 096-003 (12)
* TEE 012-197
ASSY, IPC-2 MANUAL VALVE 900-002-G1
* INSTRUCTION MANUAL 074-060
OR
FARADAY CUP SENSOR 012-001 OR 017-600
ORIENT TEE TO SUIT INSTALLATION SPACE REQUIREMENTS
TO VACUUM SYSTEM
1/4-28 x 7/8" LG HEX HD. CAP SCREW (6) △ 096-004
IPC-2 SYSTEM WITH MANUAL VALVE AND TURBO PUMP 900-001-G3 (WITH BACKING PACKAGE) 900-001-G5 (LESS BACKING PACKAGE)
* DENOTES ITEMS INCLUDED IN IPC-2 SHIP KIT, 900-038-G1
GASKET, PUMP ORIFICE * 012-318
ELECTRON MULTIPLIER SENSOR 012-002 OR 017-601
5/16-24 x 2" LG HEX HD. CAP SCREW (6) △ 097-001
6" x 2 3/8 REDUCING FLANGE 050-030
TURBO PUMP SYSTEM WITH BACKING PACKAGE 012-398 WITHOUT BACKING PACKAGE 012-399
GASKET SUPPLIED WITH PUMP
5/16-24 HEX NUT (16) △ 097-002
△ DENOTES ITEMS INCLUDED IN TURBO PUMP SHIP KIT 012-372
SHIP KIT ALSO INCLUDES:
LUBRICATION KIT 012-373
TURBO PUMP MANUAL 074-018
TURBOMOLECULAR PUMP 012-357
KF 25 SEAL AND CLAMP SUPPLIED WITH PUMP
VENTING DEVICE ASSY 012-371
FREQUENCY CONVERTER 012-370
OPTIONAL AIR COOLER 012-400
BACKING PACKAGE
SMOKE ELIMINATOR 017-378
FVC HOSE, 40 IN. LONG 012-359
KF 25 CENTERING RING & SEAL (2) 012-375
KF 25/16 CLAMP (2) 012-376
KF 25/16 REDUCER 012-377
KF 25 SEAL AND CLAMP (2 EA) SUPPLIED WITH PUMP
ROTARY VANE PUMP 012-379

Figure 18 - IPC-2 System w/Manual Valve and Turbo Pump

INFICON SPARE PARTS

Description	Weight	Part No.
IPC-2		
1 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 012-251
10 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 012-247
150 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 012-242
1 torr (1000 millitorr), orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 012-241
10 torr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 012-237
8 millitorr (maximum pressure)	1 lb.	IPN 012-248
15 millitorr (maximum pressure)	1 lb.	IPN 012-246
25 millitorr (maximum pressure)	1 lb.	IPN 012-245
35 millitorr (maximum pressure)	1 lb.	IPN 012-244
60 millitorr (maximum pressure)	1 lb.	IPN 012-243
Restrictor Gasket - special gasket used between the pump and the IPC-2 (one included with each IPC-2)	1 lb.	IPN 012-318

HIGH FLOW OPTION FOR TURBOPUMPED IPC-2

Additional spare parts for the Turbo System are described in the Turbovac 150 Spare Parts List.

1 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 900-061-P4
10 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 900-061-P3

INFICON SPARE PARTS

Description	Weight	Part No.
HIGH FLOW OPTION FOR TURBOPUMPED IPC-2 (cont'd)		
150 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 900-061-P2
1 torr (1000 millitorr), orifice (maximum pressure) metallic foil orifice disc	1 lb.	IPN 900-061-P1
High Flow Restrictor Gasket - special gasket used between the pump and the IPC-2 (one included with each IPC-2)	1 lb.	IPN 900-038-P2

All orifices are replaceable and reuseable.
For special orifices, contact INFICON.

INDEX

Air cooler installation 22
Backing pump 6
ConFlat flanges 2
Electropneumatic valves - assembling with 7
Gas analysis 15
Heating jacket assembly 21
Illustration and diagram listing vii
Inspection 1
Installation 2
Introduction i
Ion pump
- Installation 5
- Shut down 16
- Start-up 13

Inventory 1
Maintenance 19
Orifice, replacing 8
Outline diagram v
Part number listing 1
Rotary vane pump, assembling 6
Service department listing ii
Shipping instructions ii
Smoke eliminator, assembling 6
Spare parts list 29
Theory of operation 17
Turbo pump
- Installation 5
- Maintenance 19
- Shut down 16
- Start-up 14
- w/Air Cooler 22

Varian spare parts listing 29
Warranty ii

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